

Surgical Management of the Injured Large Bowel

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SUMMARY

Many of the observations made in the management of large bowel injuries during World War II are applicable to similar cases encountered in civilian practice.

Early administration of whole blood to combat shock cannot be overemphasized.

The patient should be adequately examined for associated injuries.

Ether-oxygen is the anesthetic agent of choice, and a closed technique should be used.

Vertical incision offers the best exposure for the operation and is most rapidly performed.

The surgical principles of exteriorization and/or a proximal colostomy to completely divert the fecal stream are the important features in the technical management of the injured large bowel.

A method of colostomy closure is presented.

EXPERIENCES gained in the last war have served to crystallize current knowledge of the surgical management of the injured large bowel. The present surgical concept in the management of patients with such injuries comprises proper treatment of shock, which is present in most cases, adequate postoperative care with judicious use of chemotherapeutic and antibiotic agents, and the employment of the surgical principle of exteriorization of the injured segment of bowel.⁶ Comparison of mortality rates in the first World War with those of the second gives a striking example of the effectiveness of this course of management. Penetrating wounds of the colon in World War I caused death in 45 per cent of cases. In World War II, in which many of the wounds were caused by more destructive missiles, the mortality rate was between 15 and 20 per cent.⁷

Preoperative Management. Intra-abdominal injuries due to penetrating or perforating wounds almost always are attended by shock of various degrees. This must be combated early. While plasma is beneficial, whole blood is far more efficacious. Certainly if there is continuing hemorrhage or advancing peritonitis, satisfactory response to blood transfusions is not obtained, and the surgeon is forced to proceed with the operation.⁵ He must then rely on support of the patient by transfusions during and after operation. The blood pressure of the

patient, although one of the least valuable gauges of impending shock, is one that is frequently used for that purpose. A far more reliable guide is hematocrit measurement, for hemoconcentration occurs before the fall of blood pressure and is thus an earlier index of impending shock.

Nasogastric intubation, with removal of gastric contents, is an important measure to prevent the aspiration of this material during anesthesia. If passage of the tube provokes vomiting, that is fortunate. Testing of the nerve function of the extremities, and a rectal examination to determine the presence of fresh blood, indicative of injury to the rectum, are two of the most commonly overlooked procedures in the preoperative examination.

Anesthesia. Ether-oxygen for anesthesia, with a closed system and preferably use of an intratracheal tube, is the method of choice. Supplemental block of the field either by local infiltration or the injection of the lower intercostal nerves in the axillary line may minimize the necessity for carrying the patient into the deeper levels of anesthesia.⁸ Facilities should be available for bronchoscopy if there is reason to believe that gastric contents may have been aspirated into the tracheobronchial tree. Postoperative pneumonia caused by aspiration of such material ranks with peritonitis as a life-endangering complication.

Incisions. In the acute case, the vertical paramedian incision affords the most useful approach and is least liable to complications. Fecal contamination of the peritoneal cavity is usually reflected by postoperative infection of the abdominal wall.⁴ When conditions permit, it is preferable to close the peritoneum and posterior rectus sheath in one suture line. The remainder of the abdominal wall is loosely approximated, preferably with stay sutures of braided silk, cotton, or wire. The skin is left unsutured. The provision of adequate drainage of the abdominal wall incision, the avoidance of buried sutures and ligatures, and a loose rather than taut approximation of the stay sutures, are the most effective measures in the prevention of infection and postoperative hernia. While incisional hernias are not within the scope of this presentation, these were observed frequently when wounds broke down because of improper suture. Therefore abdominal closure without the use of buried catgut sutures should be emphasized. The meticulously closed abdominal incision, while cosmetically pleasing, is fraught with danger of sepsis of the wound and subsequent dehiscence.

When it is necessary to exteriorize segments of bowel or to provide intraperitoneal drainage for, or in anticipation of, localized sepsis or a fecal fistula,

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secondary incisions are made. These are short, laterally placed incisions that follow the direction of the fibers of the external oblique muscle.⁴ In the upper abdomen, incisions for the exteriorization of bowel must not impinge on the costal arch, for that would make closure difficult.

Management of the Injured Colon. One of the great contributions to surgical management of the injured large bowel has been the recognition of the fact that perforations of the large bowel should not be sutured primarily, but rather that the segment of bowel should be exteriorized or the fecal stream diverted by proximal colostomy. This principle is in contrast to injuries of the small bowel. Its strict application during the war resulted in the saving of many lives. It is important, however, to note the distinction between exteriorization of a wounded segment of bowel, and colostomy to divert the fecal stream. At times both purposes may be accomplished by one and the same procedure, but a clear understanding of the purpose of the operation is essential to the selection of the techniques involved. For either purpose, the basic technical requirement is adequate mobilization of the segment of the large bowel that is brought to the surface of the abdominal wall. Sufficient mobilization is not always easy in the fixed portions of the colon or in the flexures or rectosigmoid region. But insufficient mobilization, with dependence upon sutures or clamps to maintain the bowel in its abnormal position, frequently results in retraction. This leads to a fecal fistula that may be difficult to repair, or, in the case of an improperly functioning colostomy, defeats the purpose of the operation by allowing fecal matter to enter the distal segment. Early in convalescence, retraction of the bowel may result in life-endangering abdominal wall infections, or intraperitoneal sepsis.

Exteriorization. Exteriorization of the damaged segment through a laterally placed muscle-splitting incision is the established procedure in the management of wounds of the large intestine.⁴ The loop of bowel must lie comfortably on the abdominal wall without tension and with proper orientation of its proximal and distal limbs—that is, not twisted on itself. When the limbs are twisted, the application of a spur crushing clamp may endanger the blood supply in the subtending mesentery. When the bowel is properly exteriorized, the mesentery falls naturally into a fold on the medial aspect of the loop, leaving the bowel walls in contact on the lateral side.

In cases in which the injury is larger than one-half of the diameter of the bowel, or a segment has to be resected because of damage done to the mesentery, exteriorization takes the form of a double-barreled spur. Sutures may be placed to approximate the antimesenteric borders of the intraperitoneal portions of the limbs for subsequent crushing by a clamp. Care must be taken not to penetrate the lumen of the intestine or to strangle the vessels by suture.

Sigmoid Colostomy is required to divert the fecal stream in cases of injury to the pelvic colon below the level at which exteriorization is possible.⁵ If the perforation is at a point so low as to make it impossible to exteriorize the bowel, the perforation is repaired by suture and a proximal colostomy is performed. Sigmoid colostomy is, therefore, indicated in wounds of the rectum and in certain perineal and buttocks wounds as an aid to wound healing and secondary suture. Such wounds are frequently contaminated. A tube colostomy or cecostomy does not divert the fecal stream from the remainder of the colon and should therefore not be used. Colostomy in the left half of the transverse colon is a useful procedure in the presence of extensive pelvic injuries that require subsequent repair by the abdominal route. This is particularly true if a suprapubic cystostomy is also indicated, or if there is also extensive damage to the left lower quadrant of the abdomen. Placement of the colostomy in the laparotomy incision or in a defect produced by the missile causing the wound is to be avoided, because all too frequently this results in infected incisions and hernias. Formation of a loop with proper orientation of the bowel provides an adequate sigmoid colostomy. Formal construction of a long spur is not necessary and actually may be undesirable. Extensive damage to the lower bowel segment, associated injury to the bladder and urethra, wounds that extensively compound the bony pelvis, and injuries to the rectum, are examples of injuries that require a prolonged and completely functioning artificial anus. Here the loop must be made sufficiently long to allow for complete transverse section of the bowel and some separation of the two stomata. As ultimate closure will be by end-to-end suture, formation of a spur is not desirable.

Cecostomy. Tangential perforations of the cecum are best managed by exteriorization. Single perforations require mobilization of the bowel in a search for retroperitoneal perforations. Cecostomy, even when necessary because of direct injury to the cecum, should not be employed as a substitute for proximal colostomy when the indications for the latter are present.

Right Colostomy. In extensive injuries necessitating resection of the cecum, the most important principle to observe is complete separation of the ileostomy from the laparotomy incision or from a large abdominal wall defect. The most satisfactory method for dealing with the end ileostomy is a separation of the ileum from the proximal end of the colon by creating a terminal ileostomy in a separate incision in the right lower quadrant and exteriorization of the end of the colon below the costal margin. Every effort should be directed toward the early anastomosis of the ileum to the transverse colon.²

Perforation of the Rectum. Wounds of the rectum are characterized by inaccessibility, difficulty of diagnosis, frequent associated damage to other

structures, and the hazard of pelvic and ascending retroperitoneal cellulitis. Deviations from the principles established for the management of wounds of the rectum lead to serious complications. Colostomy (not cecostomy) is mandatory. Colostomy should completely divert the fecal stream, and usually should be located in the sigmoid colon. Free posterior drainage must be obtained. This is best established by incision of the fascia propria, thus exposing the rectal, sacral, and paramedian spaces. Attempts to drain the retroperitoneal space through a wound of the buttocks have usually met with disaster. In establishing posterior drainage, it may be desirable to increase the exposure by removal of the coccyx. This is done as a disarticulation of the coccyx by sharp dissection and erasure of the exposed articulating cartilage, and not by incomplete amputations with bone forceps.⁵

Postoperative Care. Complete and adequate postoperative care of the critically wounded patients is vital.⁶ Briefly, (1) nasogastric suction, (2) the administration of whole blood and plasma, (3) parenteral fluid therapy in quantities large enough to insure a 24-hour output of 1,200 to 1,500 cc., (4) aspiration of tracheobronchial secretions to prevent postoperative atelectasis and pneumonia, and, (5) the use of chemotherapeutic and antibiotic agents. The latter in the form of penicillin and streptomycin, both intraperitoneally and parenterally, are apparently standing the test of time.

Closure of Colostomy. The author has evolved certain principles to follow in the closure of colostomies:

(1) An inadequately functioning colostomy deteriorates into a useless fecal fistula when it no longer diverts the fecal stream. It should be either closed or reestablished as an effective artificial anus, depending upon the conditions of the bowel below it.

(2) Whenever feasible, spur crushing clamps should be applied. Care in this procedure must be exercised to make sure that the mesentery is not between the two limbs of the bowel, and that the limbs are not rotated.

(3) Extraperitoneal closure of colostomy has proved to be best, in the author's experience. (In only a few instances was it necessary to carry out a formidable intraperitoneal end-to-end suture.) The bowel is freed down to the peritoneum and, after closure, is placed in the extraperitoneal space. Closure of the abdominal wall over the bowel is effected with cotton sutures. Postoperative x-ray studies of the colon with barium enemas have given no evidence of obstruction. In those instances in which after closure of the colostomy the lumen appears to be inadequate, it is supplemented with small side-to-side anastomosis between the proximal and distal limbs.

4. The author has not hesitated to repair large incisional hernias at the same time that the colostomy was closed. Cotton sutures or fascial transplants are employed. Keene³ is of the opinion that the primary intraperitoneal end-to-end closure of the colostomy affords the best postoperative results.³ The author has not found it necessary to employ the more formidable procedure.

Although sulfasuxidine or sulfathalidine is used preoperatively, sulfanilamide crystals locally in the wound were found to be completely ineffective and were discarded early. Penicillin and streptomycin are effective and are used intraperitoneally and parenterally.

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